

a) AWA Facility Status and Activities: The new 1 -1/2 cell RF photocathode gun has been in operation for the last two years. This gun has significantly improved the present AWA drive beam performance. Currently the gun produces beams with energy of ~ 7 MeV and single bunch charges up to 100 nC with the Mg cathode installed. We measured bunch lengths of 10 ps FWHM for charges up to 70 nC. We implemented an optical system for 'laser cleaning' the Mg cathode with a focused laser beam. After laser cleaning, the quantum efficiency of the installed Mg cathode improved by a factor of 5 – 10. This allows us to begin the much-anticipated high-gradient and high-power tests without waiting for CsTe based cathode. These results show that the new AWA gun has successfully reached its design goal and that the beam parameters reach the requirements of the planned two-beam acceleration experiments and other high current beam physics experiments.

Two linac structures were removed from the original AWA drive beamline and thoroughly cleaned, allowing them to be installed in the new AWA beamline without degradation of its ultra high vacuum (mid 10^{-10} Torr with RF off). One of these linac structures has already been installed and RF conditioned. The RF conditioning process took a considerable amount of time, likely due to the fact that the cleaning process altered the inner surfaces of the copper cells, but the linac is now operating at a higher power level than before. Currently, the total beam energy has been conditioned up to 13.5 MeV with goal of achieving 18 MeV. The cause of this lower beam energy is currently under investigation, but it appears to be due to some newly installed RF waveguides. We expect to fix this low energy condition soon; enabling us to conduct the high-gradient wakefield experiments.

A 15 GHz standing-wave dielectric loaded wakefield structure has been recently fabricated and installed in the AWA beamline. In addition, a 6 GHz oscilloscope was acquired and a newly developed RF mixer circuit was designed to analyze the time-domain envelope of the wakefields generated by the beam traversing the structure. Using a drive bunch charge of approximately ~ 20 nC, we have begun initial characterization of the wakefield using a carefully designed RF mixer circuit. The initial results are very encouraging and agree well with our predictions. Once these initial characterizations are completed, we will drive the structure with a higher single charge bunch (> 50 nC), to be followed by experiments with high-charge bunch trains (> 200 nC).

An RF loop antenna is installed in the vacuum port of the AWA gun to characterize the RF performance of the gun. The use of a recently acquired high bandwidth oscilloscope allows a very detailed observation of the 1.3 GHz loop antenna signal, showing the beam loading effect. Further measurements at higher bunch charges, with single bunch and bunch trains, will provide invaluable insights into the physics of high charge bunch generation.